M-18-1-STD
TERMINAL INDICATOR CONTROL MODULE TIC
FIELD SERVICE AND TRAINING MANUAL

SCOPE

The purpose of this manual is to describe the physical characteristics, the functions, and the logic of the M-18-1-STD terminal indicator control (TIC) module. The descriptions are in sufficient detail to permit the NCR Technical Representative to isolate system malfunctions caused by this module.

As a prerequisite to using this manual, the reader should be familiar with the information in *Basic Terminal Concepts* (MS 841).

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M-18-1-STD
TERMINAL INDICATOR CONTROL

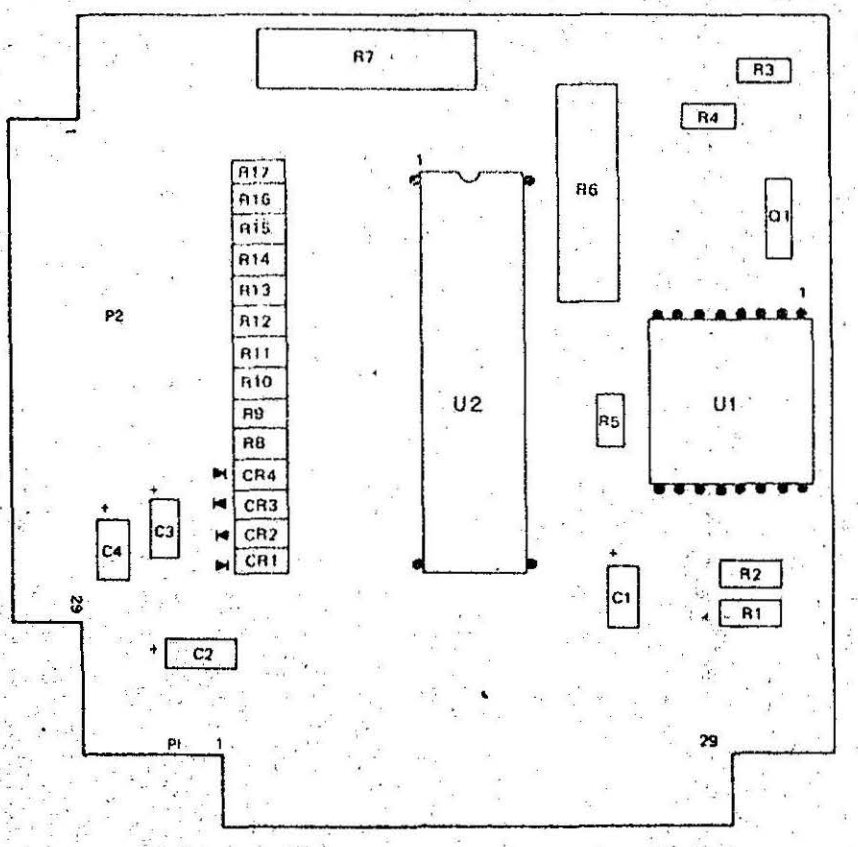

Fig. 1 M-18-1-STD TIC module

INTRODUCTION

The M-18-1-STD Terminal Indicator Control (TIC) module is used to perform some of the miscellaneous tasks within the parent unit which are not performed by any other module. The miscellaneous tasks include generating audio signals, driving indicator lamps and solenoids, and monitoring the status of switches. The TIC is connected to the common port of the terminal control unit (TCU) module. The TCU exercises complete control over the TIC.

The TIC module, shown in figure 1, is a 4-inch by 4-inch printed circuit board containing one MOS/LSI array, a 4-driver hybrid circuit pack, and a transistor driver with its associated discrete components. Various other discrete components are used for decoupling power supply, clamping the phase clocks, and providing pull-down resistance for the switch input lines.

The electrical and environmental requirements are listed below.

Voltage:

- +28 v.d.c.
- +12 v.d.c. at 6 ma
- −12 v.d.c. at 4 ma
- −6.8 v.d.c. at 1 ma

Temperature:

Operating Range	32° to 125°F
Storage Range	-40° to 160°F

Relative Humidity:

Operating Range	5 to 88 percent
Storage Range	5 to 88 percent

GENERAL DESCRIPTION

The terminal indicator control (TIC) module can execute 13 TCU-issued functions. The functions are listed in table 1.

FUNCTION	CODE			
	b_8	b_7	b_6	b_5
Output Good Tone	0	0	0	1
Output Mixed Tone	0	0	1	1
Open Cash Drawer	1	0	1	0
Reset Tones and Cash Drawer	1	0	1	1
Send Data	0	1	0	0
Set Latch 1	1	0	0	0
Reset Latch 1	1	1	0	1
Set Latch 2	1	0	0	1
Reset Latch 2	1	1	1	0
Set Latch 3	0	0	1	0
Reset Latch 3	0	1	1	1
Set Latch 4	0	1	0	1
Reset Latch 4	0	1	1	0

Table 1 TIC function codes

NOTE: Bit position b_1 through b_4 may be either zero or one.

The two output tone functions control the operation of a loudspeaker. The open cash drawer function is used to control a solenoid. To de-energize the solenoid or shut off the loudspeaker, the reset tones and cash drawer function must be issued. The send data function causes the TIC to output the status of the monitored switches to the TCU. The four set/reset latch functions permit setting any of four latches, then resetting the latches whenever instructed to do so by the TCU. The uses of the latches are controlled by the design of the parent unit.

OUTPUT GOOD TONE

The MOS/LSI array on the TIC module contains a free-running 1125-Hz tone generator. When an output good tone function code is received from the TCU, the 1125-Hz tone is applied to a loudspeaker.

After a time interval controlled by the TCU program, a reset tone and cash drawer function is issued to the TIC to stop the output of the 1125-Hz tone. The duration of the good tone may vary to indicate different conditions within the same unit. For example, the C-280 retail terminal outputs the good tone for 7 msec. to indicate a key depression and for 228 msec. to indicate the cash drawer opening.

OUTPUT MIXED TONE

In addition to the 1125-Hz tone generator, the MOS/LSI logic of the TIC contains a 3570-Hz tone generator. When an output mixed tone function is issued by the TCU, the outputs of both tone generators, 1125 Hz and 3570 Hz, are logically anded and applied to a loudspeaker.

The TCU controls the length of time that the mixed or error tone is held on. The time may vary from one parent unit to another and within any one unit to indicate different errors. For example, the C-270 holds the error tone for 392 msec. to indicate any error, but the C-280 holds the tone for 100 msec. to indicate an operator error and 150 msec. to indicate a color bar coded tag read error. When the proper length of time has elapsed, the TCU issues a reset tone and cash drawer function to stop the output of the error tone.

OPEN CASH DRAWER

The open cash drawer function is used to activate a solenoid driver. Although the function name indicates exclusive use in opening a cash drawer, the solenoid driver can be used to activate any circuitry requiring approximately 1 ampere drive current.

After receiving an open cash drawer function, the solenoid driver remains on until a reset tone and cash drawer function is received by the TIC.

RESET TONES AND CASH DRAWER

The reset tones and cash drawer function is used to stop the outputting of the error tone or good tone, and to de-energize the driver activated by an open cash drawer function. After issuing an output good tone function, an output mixed tone function, or an open cash drawer function, the TCU waits a predetermined length of time before issuing a reset tone and cash drawer function.

SEND DATA

The TIC module is capable of monitoring the status of eight switches. In order to obtain the switch status from the TIC, the TCU must issue a send data function. The switch data is transferred to the TCU as one eight-bit character in the second character time after receiving the send data function.

Each bit of the switch data character corresponds to a switch DATA line. For example, the status of the switch connected to the DATA 1 line is transferred to the TCU as the first bit of the switch data character; the DATA 2 line switch is the second bit, and so on through the DATA 8 line switch as the eighth bit of the switch data character.

SET AND RESET LATCH FUNCTIONS

The MOS/LSI logic array of the TIC module contains four latches, each of which can be set and reset independently of the others. Latch 1 and latch 2 of the array have drivers connected to their outputs. These drivers are ordinarily used to provide current for indicator lamps but could be used to drive other low current devices. Latch 3 and latch 4 have no connections external to the array.

The drivers are turned on when a set latch function is issued to the TIC. A reset latch function turns off the driver. The time between the setting and resetting of a latch is controlled by TCU firmware.

LOGIC DESCRIPTION

The logic contained in the MOS/LSI array U2 is divided into five segments as shown in the block diagram, figure 2. The five segments are function decode, latches, tone generators, cash drawer flip-flop, and data/status transfer.

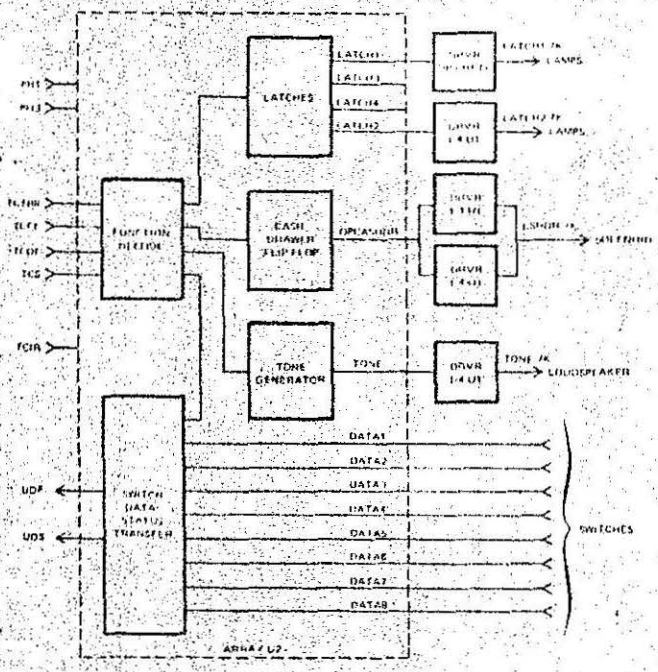

Fig. 2 TIC module block diagram

FUNCTION DECODE

The function code is input to the TIC module on TCDF. In order to decode the character on the TCDF line, three other lines from the TCU are monitored: TCTB8, TCFF, and TCS.

TCTB8 is used to generate timing within the array. As TCTB8 goes High, a timing chain of seven pulses, each one bit time long, is generated. The pulses are used to determine which bit of the function character is being sampled.

TCFF is Low for one character time to indicate that the character on the TCDF line is a function character as opposed to a data character. This module does not receive data characters.

The TCS line, like TCDF, is Low for the one character time in which the function character is transferred. The TCS line, TCU strobe, selects the TIC module as the module to accept the function. Each port of the TCU common port has a unique numeric designation for the TCS line. The numeric designation of the TCS line is determined during the design of the parent unit and, therefore, is a different number for different parent units.

The TIC logic recognizes the state of the four most significant bits of the function character and, during a subsequent character time, initiates the prescribed function.

LATCHES

The logic array U2 contains four latches which can be set or reset individually by TCU-issued functions. Only two of the four latches (latch 1 and latch 2) have outputs that leave the board. The outputs are through drivers: one a hybrid circuit and the other composed of a darlington transistor and bias resistors.

The drivers are ordinarily used as lamp drivers but may, at the discretion of the parent unit designers, be used for any low current application. A driver is activated when the associated latch is set and deactivated when the latch is reset.

CASH DRAWER FLIP-FLOP

During the character time following the receipt of an open cash drawer function, the TIC logic sets a flip-flop, OPCASHDR. The output of the flip-flop is connected to a solenoid driver. The solenoid driver is activated when the flip-flop is set.

The driver consists of two parallel-connected darlington transistors in hybrid U1. The output of the driver, CSHDR.7K, goes to ground when the driver is activated.

After a time determined by the TCU firmware, the TCU issues a reset tone and cash drawer function. Receipt of this function resets OPCASHDR, which in turn deactivates the driver.

TONE GENERATOR

Two counters within logic array U2 are used to generate an 1125-Hz signal and a 3570-Hz signal. The tone-generating counters are permitted to free run. When an output good tone function is received, the output of the 1125-Hz counter is anded with the output of the good tone function flip-flop to produce a term called TONE. TONE is also generated when an output mixed tone function is received, but the term is produced by logically mixing the outputs of the two tone counters and then anding the resulting tone with the output of the mixed tone function flip-flop.

TONE is input to one of the four darlington drivers located in the hybrid driver pack U1. The output of the driver, TONE.7K, is connected to a speaker.

The TCU issues a reset tone and cash drawer function to reset the tone function flip-flop. When the flip-flop is reset, TONE is reset to ground to deactivate the driver and speaker.

SWITCH DATA AND STATUS TRANSFER

The TIC module is constantly outputting an operable status code (0001XXXX) to the TCU on the UDS line. When the TCU instructs the TIC to transfer switch data to the TCU on UDS, the UDF line is taken Low for the character time during which the data transfer is made. After transferring the switch data character, the TIC reverts to transmitting the operable status character.

The switch data transferred to TCU consists of one eight-bit character. Each bit of the data character corresponds to one of the eight switch data lines (DATA1.9T through DATA8.9T). For example, bit 3 of the data character is High if DATA3.9T is +12 v.d.c.

The switch data lines are tied through 1K resistors to ground. Grounding the lines provides a definite logic level input to the array if there is no switch connected to the line or the switch connected to the line is open. The common terminal of each switch is connected to +12 v.d.c. and either the normally open or normally closed terminal may be connected to the switch data line.

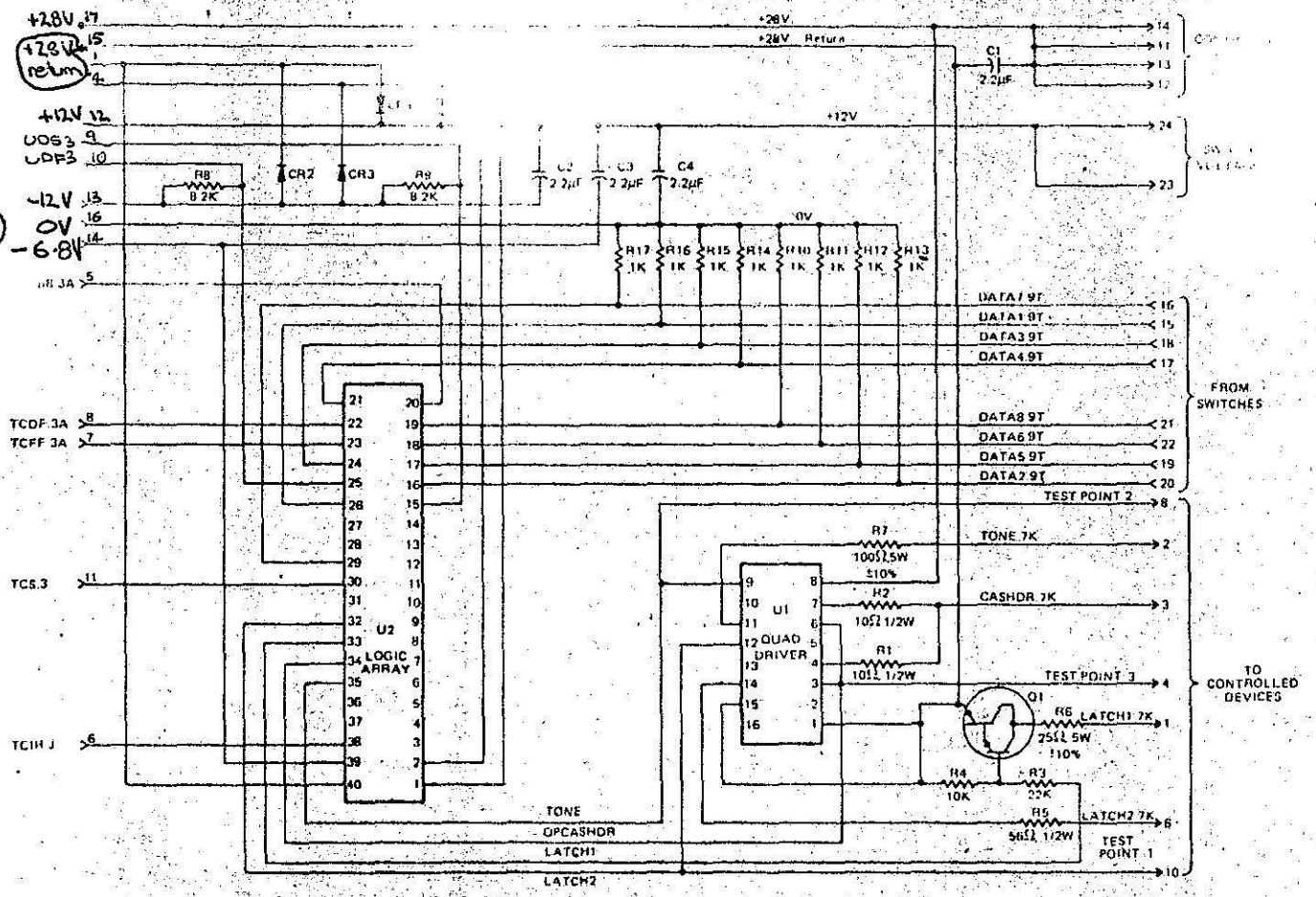

Fig. 3 M-18-1-STD schematic

ELECTRICAL DESCRIPTION

The terminal indicator control module, shown schematically in figure 3, contains an MOS/LSI logic array (U2), a hybrid driver pack (U1), a darlington transistor (Q1), and various discrete components.

The MOS/LSI array contains the logic necessary to perform the functions of the TIC module. This 40-pin array uses -6.8 v.d.c. and +12 v.d.c. for logic voltages. The inputs to the array consist of the common port lines and the switch data lines. TONE, OPCASHDR, LATCH 1, and LATCH 2 are usable outputs. LATCH 3 and LATCH 4 outputs are not used by the module.

The 16-pin hybrid driver pack contains four darlington driver circuits. The inputs to the drivers are from the logic array. The outputs are to driven devices such as a loudspeaker, a solenoid, and indicator lamps.

The darlington transistor and its associated resistors (R3, R4, and R6) are used as a driver for devices such as indicator lamps. The input to this driver is LATCH 1 from the logic array.

Four capacitors are used for filtering the various voltages. C1 filters the +28 v.d.c. to the +28 v. return line. C2 filters the -12 v.d.c. supply to the +12 v.d.c. supply. The logic array voltage, -6.8 v.d.c., is filtered to the +12 v.d.c. through C3. The +12 v.d.c. used as the switch voltage is filtered through C4.

Four diodes, CR1 through CR4, are used to ensure that phase clocks PH1 and PH2 have a voltage swing limited between +12 v.d.c. and -12 v.d.c.

Current limiting for the hybrid driver outputs is provided by R1, R2, R5, and R7. Resistors R10 through R17 are used as pull-down resistors for the switch data lines. The UDF line and UDS line are provided with pull-down resistors, R8 and R9, to -12 v.d.c. These resistors are necessary because the drivers for the lines are not provided with collector voltage within the logic array.

SUMMARY

The M-18-1-STD terminal indicator control (TIC) module contains logic to control and monitor various devices within the parent unit. The module controls the operation of the loudspeaker used for audible indication of the parent unit status and provides drive current for miscellaneous circuitry. Up to eight switches can be monitored by the TIC module.

The TIC can respond to any of 13 function codes, but only nine are used. The nine used functions are output good tone, output mixed tone, open cash drawer, reset tones and cash drawer, send data, set latch 1, reset latch 1, set latch 2, and reset latch 2.

SERVICE INFORMATION

This section contains information to aid the NCR Technical Representative in isolating system malfunctions to this module. The information includes the module pin connections and the module test points.

PIN CONNECTIONS

The pin connector block diagram, figure 4, is supplied for the use of the technician in the event that he must trace the wiring.

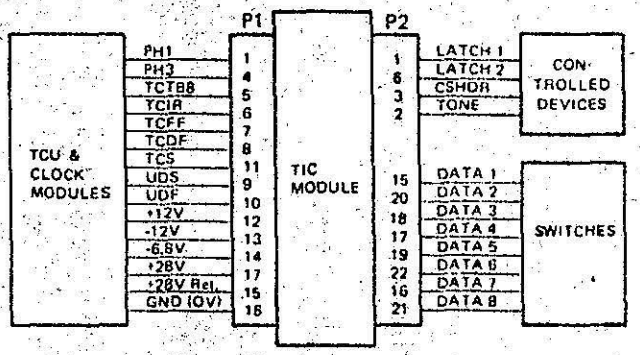

Fig. 4 Pin connector block diagram

COMMON PORT

The description of the common port lines is located in the communications section of the *M-15 Terminal Control Unit Manual* (MS-415).

CONTROLLED DEVICES

Four lines are output from the TIC module to controlled devices: CSHDR.7K, LATCH1.7K, LATCH2.7K, and TONE.7K. These lines are taken to ground when active.

CASHDR.7K — The cash drawer line is taken to ground (0 v.d.c.) to provide a current path to ground for +28 v.d.c. through the controlled device.

LATCH1.7K — The latch 1 line is used to control a low current device such as an indicator lamp. The supply voltage for this device is +28 v.d.c.

LATCH2.7K — The latch 2 line is also used to control a low current device. The supply voltage for the device is ordinarily +28 v.d.c.

TONE.7K — The tone line carries the good tone frequency and the mixed tone frequency to a loudspeaker. The speaker coil is energized when TONE.7K is taken to ground to complete the current path to the +28 v.d.c. supply.

SWITCHES

The switch lines transfer the state of the parent unit switches to the TIC module. The eight lines, designated as DATA1.9T through DATA8.9T, operate at +12 v.d.c. and 0 v.d.c. When any given switch is closed, the corresponding data line is taken to +12 v.d.c. Opening the switch takes the line to 0 v.d.c. The 0 v.d.c. is supplied through pull-down resistors on the TIC module.

TEST POINTS

Three test points are provided on the TIC module to permit the technician to monitor the inputs to the darlington drivers in U1. Test point 1 (P2-10) is the input to the LATCH2.7K driver. The input to the TONE.7K driver can be monitored at test point 2 (P2-8). Test point 3 (P2-4) permits monitoring of the CSHDR.7K driver input. The input to the LATCH1.7K driver can be tested at the base of Q1.